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(54) Pipe joint

(57) The outer periphery of each of two drive pipes 1 butted with each other is provided with a stepped end portion 15 having inclined ramp surfaces 16 and engagement surfaces 17. The ramp surfaces 16 gradually reduce in diameter toward the pipe end. The engagement surfaces 17 gradually increase in diameter toward the pipe end. The butted pipes 1 are connected together by a joint tube 18 having a cylindrical outer shell 19 of stainless steel or reinforced plastics and a synthetic rubber seal member 20 mounted on the inner surface of the shell 19 and in intimate contact with the stepped end portions 15.

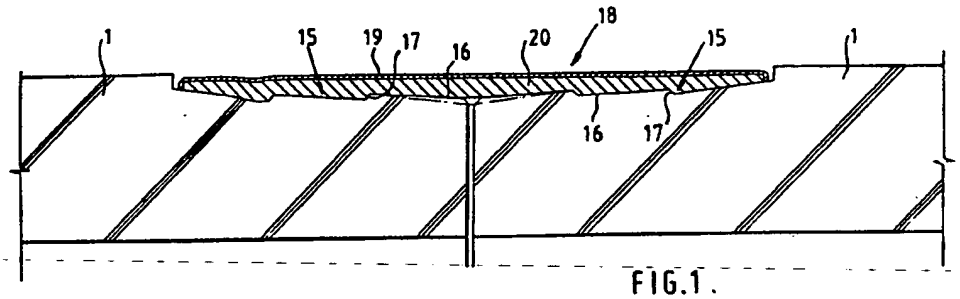

FIG.1.

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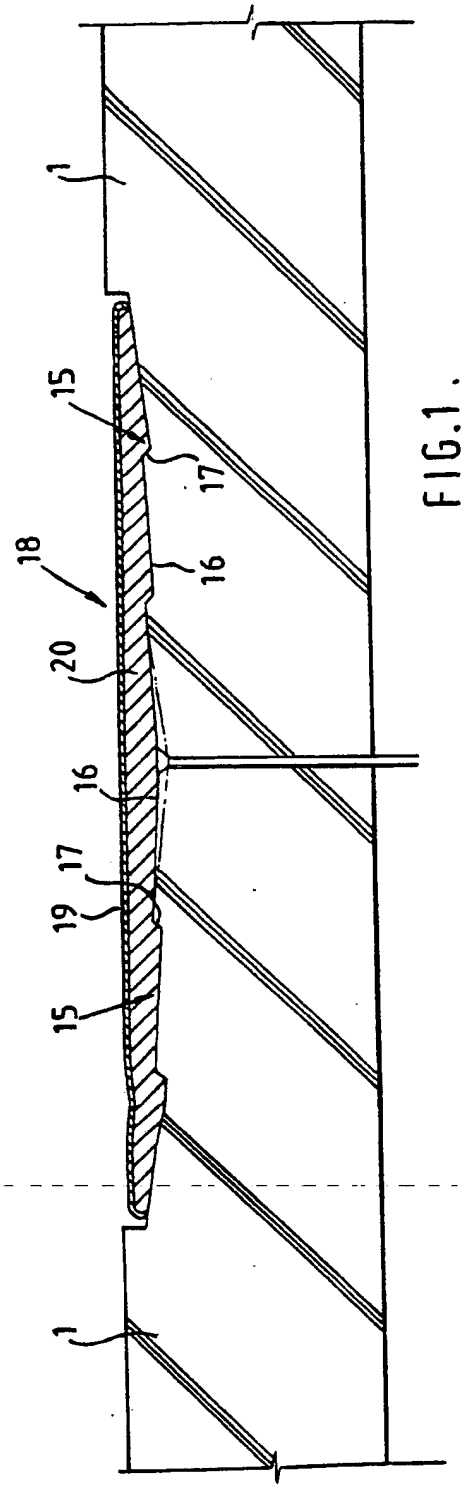

FIG.1.

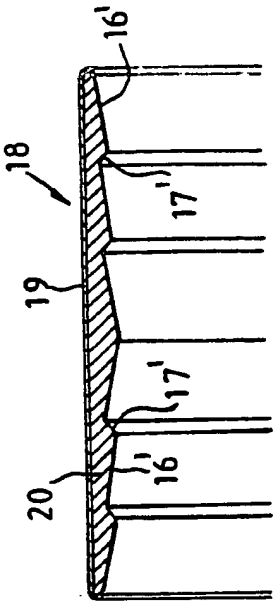

FIG.3.

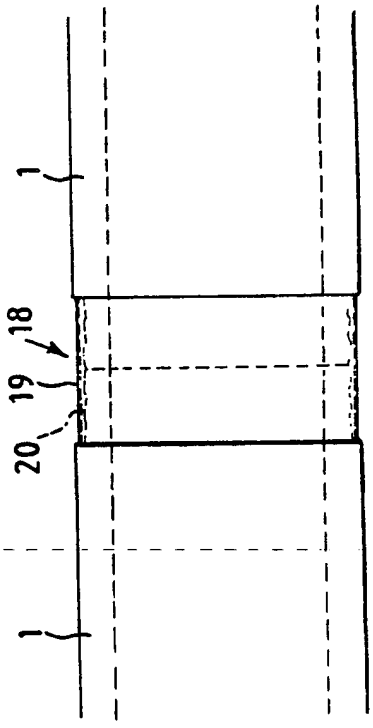

FIG.2.

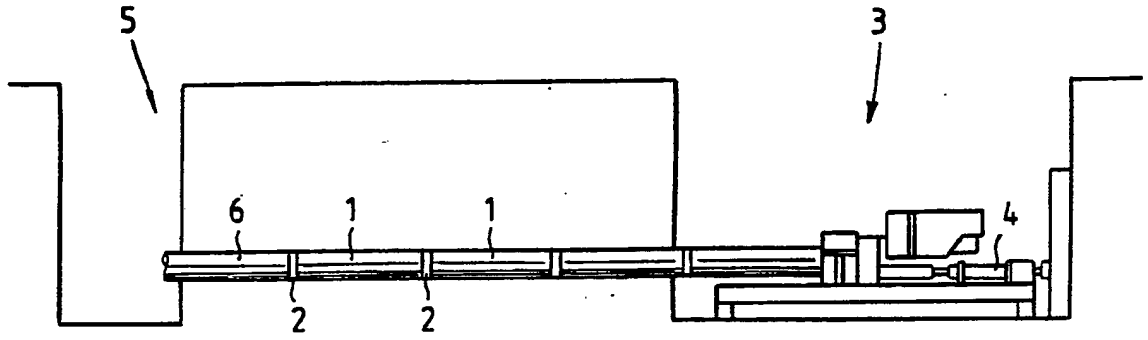

FIG.4.

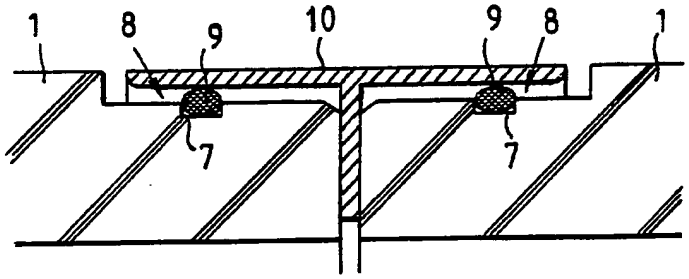

FIG.5.

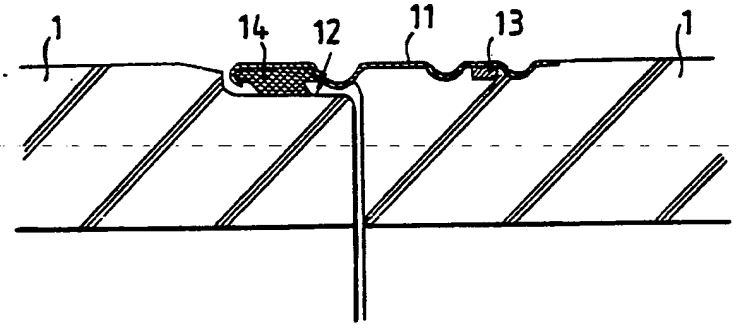

FIG.6.

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PIPE JOINT

This invention relates to a pipe joint in which two pipes are joined end-to-end and, more particularly, to the structure of a joint section connecting small-diameter Hume pipes with an inner diameter of about 700 mm or below which are buried by a drive-forward process or the like.

For sewerage works in recent municipal environment maintenance, drive-forward processes based on horizontal auger systems or the like are finding greatly increasing applications in the case of Hume pipes with inner diameters not greater than 700 mm. In such drive-forward processes, as shown in Figure 4 of the accompanying drawings, drive pipes 1 to be buried are connected with each other by joints 2, and a plurality of pipes which are connected one after another are buried by driving them forwards simultaneously using a drive jack 4 installed in a start pit 3. In Figure 4, reference numeral 5 designates an end pit, and 6 a leading pipe.

Figure 5 shows the structure of a joint section which has heretofore been generally used to connect pipes which are driven forwards as noted above. The surface of an end portion of each drive pipe 1 is formed

with a stepped portion 8, and a circumferential annular groove 7 is formed in the stepped portion 8 at an axially intermediate position. An impervious rubber ring 9 is fitted in each groove 7, and an annular steel collar 10 having a T-shaped sectional profile is fitted on the adjacent stepped portions 8 of two end-to-end butted drive pipes 1, thus forming a joint.

Figure 6 shows a joint structure of buried collar type which has been developed for providing improved water stopping, corrosion resistance, installation control, etc. In this case, one end portion of a stainless steel collar 11 having a wavy sectional profile is securedly fitted on one pipe 1, and the other pipe 1 has a stepped end portion 12 inserted into the other end portion of the collar 11. In Figure 6, reference numeral 13 designates swelling rubber or expanded rubber which is embedded together with the stainless steel collar 11 when the pipe 1 is manufactured, and reference numeral 14 designates impervious rubber fitted on the stepped end portion 2.

The steel collar 10 shown in Figure 5, however, when used for the drive-forward process of burying the pipes, is subject to a number of problems, e.g. that the collar is deformed as this time, that it is held in insufficiently close contact with the rubber ring 9, and that it is deformed when the rubber ring 9 is press fitted. In such cases, the joint is prone to leakage.

Further, if the direction of forward driving of pipes is controlled, stress concentration in the joint section results. A steel collar, which has poor flexibility, cannot alleviate such stress concentration, so that the joint is liable to be broken or the pipe damaged. Further, since the drive pipes 1 are of small diameter, it is impossible to perform space-filling with respect to the sandwiched flange end portion of the steel collar 10 from the inside of the pipe, so that the steel collar is liable to be corroded by liquid flowing through the pipes. Further, rusting-proof paint on the outer periphery of the steel collar 10 is liable to be detached by friction when the pipes are driven, so that leakage due to corrosion is inevitable.

The stainless steel collar 11 shown in Figure 6, on the other hand, has some flexibility, has excellent corrosion resistance, is less subject to deformation of the collar, and has satisfactory installation control property. However, the processing of the stainless steel collar 11 and fitting thereof on a drive pipe are time-consuming, thus leading to a comparatively high cost. Further, leakage prevention mainly depends on the impervious rubber ring fitted on the stepped end portion and is not sufficient at all times.

The present invention provides a joint section for (drive) pipes, in which the outer periphery of each of two pipes (consisting of two small-diameter Hume pipes)

butted with each other, is provided with a stepped end portion having pluralities of inclined surfaces and engagement surfaces (in its section in a plane containing the axis of the pipe), said inclined surfaces having the diameter gradually reducing toward the tube end, said engagement surfaces having the diameter gradually increasing toward the tube end, and said butted pipes are connected together by a joint tube including a (cylindrical) outer shell and a (synthetic rubber) seal member mounted on the inner surface of said outer shell and held in close-contact engagement with said stepped end portions of said pipes.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a sectional view showing an embodiment of a pipe joint in accordance with the present invention;

Figure 2 is a front view showing the joint of Figure 1, on a smaller scale;

Figure 3 is a sectional view showing a joint tube with a mounted seal member;

Figure 4 is a schematic sectional view showing a process of installation of drive pipes by driving them; and

Figures 5 and 6 are sectional views of prior art examples of pipe joints.

In the pipe joint shown in Figures 1 and 2, a joint tube 18 is used which comprises a thin cylindrical outer shell 19, made of relatively rigid material such as stainless steel or reinforced plastics material, and a resiliently deformable seal member 20, made of synthetic rubber, provided on the inner surface of the outer shell 19. The seal member 20 has a shape corresponding to the snape of stepped end portions 15 of two drive pipes 1, as will be described later. The stepped end portion 15 of each of two pipes 1 to be connected together is fitted in the joint tube 18 and is held in close contact with the seal member 20 over the entire length of the stepped end portion 15, thus ensuring leakage prevention.

The stepped end portion 15 formed in the outer periphery of the pipe 1, in axial section, has an alternate arrangement of inclined ramp surfaces 16 and inclined engagement surfaces 17. The ramp surfaces 16 have a diameter reducing toward the tube end, while the engagement surfaces 17 have a diameter increasing toward the tube end.

As the seal member 20 a moulded synthetic rubber member is used. If swelling rubber or expanded rubber is used, close contact and leakage prevention after installation can be improved.

In correspondence to the shape of the stepped end portions 15, the seal member 20 mounted on the inner surface of the outer shell 19 of the joint tube 18 has

inclined ramp surfaces 16' and inclined engagement surfaces 17' as shown in Figure 3. When connecting the pipes 1, the engagement surfaces 17' of the seal member 20, which have cleared the ramp surfaces 16 of the stepped end portions 15, engage with the engagement surfaces 17 of the stepped end portions 15, so that the seal member 20 and stepped end portions 15 are held in close contact with each other over the entire length of the stepped end portions 15.

The outer shell 19 has an outer diameter which is slightly smaller than the outer diameter of the pipe 1, so that frictional resistance offered when the pipes are driven may be as low as possible. In the illustrated embodiment, the opposite ends of the outer shell 19 are bent to form flanges which conceal the seal member 20.

The close contact obtained when the pipes are joined may be enhanced by selecting the thickness of a longitudinally central portion of the seal member 20 to be greater than the distance between the outer shell 19 and the outer periphery of the stepped end portion 15 of the pipe 1 as shown by double-dot-and-bar line in Figure 1.

Since the stepped end portion of the drive pipe and seal member mounted on the inner surface of the joint tube have pluralities of ramp surfaces and engagement surfaces and are held in close contact with each other in the joint section, a high leakage prevention effect can be obtained.

Since the outer shell of the joint tube has a simple, thin cylindrical shape, a material hardly subject to corrosion, e.g. stainless steel, may be utilized, and the outer shell is less liable to be deformed.

The connection of the drive pipes can be effected by merely pushing the pipe into the joint tube, and the joint tube may be readily fitted on the site or work.

Correction of the direction of progress of the drive pipes may be attained with deformation of the seal member on the inner surface of the outer shell; it may be effected without spoiling the leakage prevention.

Claims:-

1. A pipe joint in which the outer periphery of each of two pipes arranged end-to-end is provided with a stepped end portion having inclined ramp surfaces and engagement surfaces, the ramp surfaces gradually reducing in diameter toward the pipe end, the engagement surfaces gradually increasing in diameter toward the pipe end, the pipes being connected together by a joint tube comprising an outer shell and a seal member which is mounted on the inner surface of the outer shell and which is in intimate engagement with the stepped end portions of the pipes.

2. A pipe joint as claimed in claim 1, in which the outer shell is made of stainless steel.

3. A pipe joint as claimed in claim 1, in which the outer shell is made of a reinforced plastics material.

4. A pipe joint as claimed in any preceding claim, in which the thickness of a longitudinally central portion of the seal member is greater than the distance between the outer shell and the corresponding part of the outer periphery of the stepped end portions of the pipes.

5. A pipe joint as claimed in any preceding claim, in which the seal member is made of synthetic rubber.

6. A pipe joint as claimed in claim 5, in which the seal member is a moulding of swelling rubber.

7. A pipe joint as claimed in any preceding claim, in which the outer shell is cylindrical.

8. A pipe joint as claimed in any preceding claim, in which the ends of the outer shell have respective inner flanges for concealing the seal member.

9. A pipe joint as claimed in any preceding claim, in which the pipes are Hume pipes with an inner diameter of about 700 mm or below.

10. A pipe joint as claimed in any preceding claim, in which the outer shell lies within the outer diameter of the pipes.

11. A pipe joint substantially as described with reference to, and as shown in, Figures 1 to 3 of the accompanying drawings.

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